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PATENT & TRADEMARK OFFICE

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<110> MedImmune Vaccines, Inc.
Kemble, George W
Duke, Gregory M
Spaete, Richard R

<120> Attenuation of Cytomegalovirus Virulence

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<210> 2
<211> 214
<212> PRT
<213> Human cytomegalovirus

<400> 2

Met Leu Arg Leu Leu Leu Arg His His Phe His Cys Leu Leu Leu Cys
1 5 10 15

Ala Val Trp Ala Thr Pro Cys Leu Ala Ser Pro Trp Ser Thr Leu Thr
20 25 30

```
Ala Asn Gln Asn Pro Ser Pro Pro Trp Ser Lys Leu Thr Tyr Ser Lys
        35                  40                  45

Pro His Asp Ala Ala Thr Phe Tyr Cys Pro Phe Leu Tyr Pro Ser Pro
    50                  55                  60

Pro Arg Ser Pro Leu Gln Phe Ser Gly Phe Gln Gln Val Ser Thr Gly
65                  70                  75                  80

Pro Glu Cys Arg Asn Glu Thr Leu Tyr Leu Leu Tyr Asn Arg Glu Gly
                85                  90                  95

Gln Thr Leu Val Glu Arg Ser Ser Thr Trp Val Lys Lys Val Ile Trp
            100                 105                 110

Tyr Leu Ser Gly Arg Asn Gln Thr Ile Leu Gln Arg Met Pro Gln Thr
        115                 120                 125

Ala Ser Lys Pro Ser Asp Gly Asn Val Gln Ile Ser Val Glu Asp Ala
    130                 135                 140

Lys Ile Phe Gly Ala His Met Val Pro Lys Gln Thr Lys Leu Leu Arg
145                 150                 155                 160

Phe Val Val Asn Asp Gly Thr Arg Tyr Gln Met Cys Val Met Lys Leu
                165                 170                 175

Glu Ser Trp Ala His Val Phe Arg Asp Tyr Ser Val Ser Phe Gln Val
            180                 185                 190

Arg Leu Thr Phe Thr Glu Ala Asn Asn Gln Thr Tyr Thr Phe Cys Thr
        195                 200                 205

His Pro Asn Leu Ile Ile
    210
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<210> 3
<211> 179
<212> PRT
<213> Human cytomegalovirus

<400> 3

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Met Pro Ala Leu Arg Gly Pro Leu Arg Ala Thr Phe Leu Ala Leu Val
1               5                   10                  15
```

Ala Phe Gly Leu Leu Leu Gln Ile Asp Leu Ser Asp Ala Thr Asn Val
20 25 30

Thr Ser Ser Thr Lys Val Pro Thr Ser Thr Ser Asn Arg Asn Asn Val
35 40 45

Asp Asn Ala Thr Ser Ser Gly Pro Thr Thr Gly Ile Asn Met Thr Thr
50 55 60

Thr His Glu Ser Ser Val His Asn Val Arg Asn Asn Glu Ile Met Lys
65 70 75 80

Val Leu Ala Ile Leu Phe Tyr Ile Val Thr Gly Thr Ser Ile Phe Ser
85 90 95

Phe Ile Ala Val Leu Ile Ala Val Val Tyr Ser Ser Cys Cys Lys His
100 105 110

Pro Gly Arg Phe Arg Phe Ala Asp Glu Glu Ala Val Asn Leu Leu Asp
115 120 125

Asp Thr Asp Asp Ser Gly Gly Ser Ser Pro Phe Gly Ser Gly Ser Arg
130 135 140

Arg Gly Ser Gln Ile Pro Pro Asp Phe Val Pro Arg Ala Leu Ile Ser
145 150 155 160

Gly Trp Lys Leu Gly Thr Gly Thr Arg Arg Arg Arg Arg Pro Arg Pro
165 170 175

Ala Ser Ala

<210> 4
<211> 20
<212> PRT
<213> Human cytomegalovirus

<400> 4

Asn Met Ile Leu Arg Thr Ser Ser Ile Ser Glu Arg Met Ala Thr Trp
1 5 10 15

Thr Arg Arg Ser
20

<210> 5
<211> 9

<212> PRT
<213> Human cytomegalovirus

<400> 5

Ile Pro Ile Met Gly Glu Ala Arg Leu
1 5

<210> 6
<211> 23
<212> PRT
<213> Human cytomegalovirus

<400> 6

Pro Ser Asn Leu Thr Ser Arg Thr Met Arg Arg Thr Pro Ser Gly Thr
1 5 10 15

Thr Phe Arg Cys Thr Met Asn
20

<210> 7
<211> 18
<212> PRT
<213> Human cytomegalovirus

<400> 7

Pro Pro Arg Lys Trp Lys Asn Leu Arg Thr Ala Pro Ala Gly Arg Phe
1 5 10 15

Pro Asn

<210> 8
<211> 16
<212> PRT
<213> Human cytomegalovirus

<400> 8

Lys Leu Pro Cys Asn Pro Ser Arg Ser Glu Ile Pro Ser Thr Thr Arg
1 5 10 15

<210> 9
<211> 257
<212> PRT
<213> Human cytomegalovirus

<400> 9

Met Gly Cys Asp Val His Asp Pro Ser Trp Gln Cys Gln Trp Gly Val
1 5 10 15

```
Pro Thr Ile Ile Val Ala Trp Ile Thr Cys Ala Ala Leu Gly Ile Trp
            20                  25                  30

Cys Leu Ala Gly Ser Ser Ala Asp Val Ser Ser Gly Pro Gly Ile Ala
        35                  40                  45

Ala Val Val Gly Cys Ser Val Phe Met Ile Phe Leu Cys Ala Tyr Leu
    50                  55                  60

Ile Arg Tyr Arg Glu Phe Phe Lys Asp Ser Val Ile Asp Leu Leu Thr
65                  70                  75                  80

Cys Arg Trp Val Arg Tyr Cys Ser Cys Ser Cys Lys Cys Ser Cys Lys
                85                  90                  95

Cys Ile Ser Gly Pro Cys Ser Arg Cys Cys Ser Ala Cys Tyr Lys Glu
            100                 105                 110

Thr Met Ile Tyr Asp Met Val Gln Tyr Gly His Arg Arg Arg Pro Gly
        115                 120                 125

His Gly Asp Asp Pro Asp Arg Val Ile Cys Glu Ile Val Glu Ser Pro
    130                 135                 140

Pro Val Ser Ala Pro Thr Val Ser Val Pro Pro Pro Ser Glu Glu Ser
145                 150                 155                 160

His Gln Pro Val Ile Pro Pro Gln Pro Pro Ala Pro Thr Ser Glu Pro
                165                 170                 175

Lys Pro Lys Lys Gly Arg Ala Lys Asp Lys Pro Lys Gly Arg Pro Lys
            180                 185                 190

Asp Lys Pro Pro Cys Glu Pro Thr Val Ser Ser Gln Pro Pro Ser Gln
        195                 200                 205

Pro Thr Ala Met Pro Gly Gly Pro Pro Asp Ala Pro Pro Pro Ala Met
    210                 215                 220

Pro Gln Met Pro Pro Gly Val Ala Glu Ala Val Gln Ala Ala Val Gln
225                 230                 235                 240

Ala Ala Val Ala Ala Ala Leu Gln Gln Gln Gln Gln His Gln Thr Gly
                245                 250                 255

Thr
```

<210> 10
<211> 175
<212> PRT
<213> Human cytomegalovirus

<400> 10

Met Ala Arg Thr Arg Glu Ala Ser Pro Val Pro Pro Arg Ser Pro Met
1 5 10 15

Pro Ser His Ile His Thr Met Ile Phe Ser Pro Ala Trp Asn Leu Lys
20 25 30

Leu Arg Val Gly Lys Gly Arg Cys Thr Asp Ile Tyr Ala Leu Asp Phe
35 40 45

Trp Lys Arg His Phe Leu Ala Arg Asn Val Phe Ile Val Gln Thr Leu
50 55 60

Arg Lys Glu Met Cys Ala Lys Ser Glu Asn Ser Leu Ser His Arg Gly
65 70 75 80

Arg Val Thr Phe Arg Ser Asp Ala Ala Ala Val Val Val Glu Pro Arg
85 90 95

Pro Arg Pro Pro Ala Arg Gln Leu Val Pro Pro Arg Pro Arg Arg Val
100 105 110

Ala Ser Ala Ala Trp Arg Gly Glu Ala Arg Arg Ala Asp Arg Arg Ala
115 120 125

Leu Pro Ser Ala Ala Thr Val Val Val Asn Ser Pro Ser Val Arg Thr
130 135 140

Glu Val Cys Leu Ser Val Tyr Pro Ser Val Tyr Leu Ser Pro Tyr Leu
145 150 155 160

Ser Ser Val Trp Val Pro Met Ser Val Leu Ala Ala Ala Val Gly
165 170 175

<210> 11
<211> 328
<212> PRT
<213> Human cytomegalovirus

<400> 11

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Met Ser Val His Arg Pro Phe Pro Thr Arg Ser Leu Arg Phe Gln Ala
1               5                  10                  15

Gly Glu Lys Ile Met Val Trp Ile Trp Leu Gly Ile Gly Leu Leu Gly
            20                  25                  30

Gly Thr Gly Leu Ala Ser Leu Val Leu Ala Ile Ser Leu Phe Thr Gln
        35                  40                  45

Arg Arg Gly Arg Lys Arg Ser Asp Glu Thr Ser Ser Arg Gly Arg Leu
    50                  55                  60

Pro Gly Ala Ala Ser Asp Lys Arg Gly Ala Cys Ala Cys Cys Tyr Arg
65                  70                  75                  80

Asn Pro Lys Glu Asp Val Val Glu Pro Leu Asp Leu Glu Leu Gly Leu
                85                  90                  95

Met Arg Val Asp Thr His Pro Pro Thr Pro Gln Val Pro Arg Cys Thr
            100                 105                 110

Ser Leu Tyr Ile Gly Glu Asp Gly Leu Pro Ile Asp Lys Pro Glu Phe
        115                 120                 125

Pro Pro Ala Arg Phe Glu Ile Pro Asp Val Ser Thr Pro Gly Thr Pro
    130                 135                 140

Thr Ser Ile Gly Arg Ser Pro Ser His Cys Ser Ser Ser Ser Ser Leu
145                 150                 155                 160

Ser Ser Ser Thr Ser Val Asp Thr Val Leu Tyr Gln Pro Pro Pro Ser
                165                 170                 175

Trp Lys Pro Pro Pro Pro Pro Gly Arg Lys Lys Arg Pro Pro Thr Pro
            180                 185                 190

Pro Val Arg Ala Pro Thr Thr Arg Leu Ser Ser His Arg Pro Pro Thr
        195                 200                 205

Pro Ile Pro Ala Pro Arg Lys Asn Leu Ser Thr Pro Pro Thr Lys Lys
    210                 215                 220

Thr Pro Pro Pro Thr Lys Pro Lys Pro Val Gly Trp Thr Pro Pro Val
225                 230                 235                 240

Thr Pro Arg Pro Phe Pro Lys Thr Pro Thr Pro Gln Lys Pro Pro Arg
```

245 250 255

Asn Pro Arg Leu Pro Arg Thr Val Gly Leu Glu Asn Leu Ser Lys Val
260 265 270

Gly Leu Ser Cys Pro Cys Pro Arg Pro Arg Thr Pro Thr Glu Pro Thr
275 280 285

Thr Leu Pro Ile Val Ser Val Ser Glu Leu Ala Pro Pro Pro Arg Trp
290 295 300

Ser Asp Ile Glu Glu Leu Leu Glu Gln Ala Val Gln Ser Val Met Lys
305 310 315 320

Asp Ala Glu Ser Met Gln Met Thr
325

<210> 12
<211> 240
<212> PRT
<213> Human cytomegalovirus

<400> 12

Met Ser Val Lys Gly Val Glu Met Pro Glu Met Thr Trp Asp Leu Asp
1 5 10 15

Val Arg Asn Lys Trp Arg Arg Arg Lys Ala Leu Ser Arg Ile His Arg
20 25 30

Phe Trp Glu Cys Arg Leu Arg Val Trp Trp Leu Ser Asp Ala Gly Val
35 40 45

Arg Glu Thr Asp Pro Pro Arg Pro Arg Arg Arg Pro Thr Trp Met Thr
50 55 60

Ala Val Phe His Val Ile Cys Ala Val Leu Leu Thr Leu Met Ile Met
65 70 75 80

Ala Ile Gly Ala Leu Ile Ala Tyr Leu Arg Tyr Tyr His Gln Asp Ser
85 90 95

Trp Arg Asp Met Leu His Asp Leu Phe Cys Gly Cys His Tyr Pro Glu
100 105 110

Lys Cys Arg Arg His His Glu Arg Gln Arg Arg Arg Arg Gln Ala Met
115 120 125

```
Asp Val Pro Asp Pro Glu Leu Gly Asp Pro Ala Arg Arg Pro Leu Asn
    130                 135                 140

Gly Ala Met Tyr Tyr Gly Ser Gly Cys Arg Phe Asp Thr Val Glu Met
145                 150                 155                 160

Val Asp Glu Thr Arg Pro Ala Pro Pro Ala Leu Ser Ser Pro Glu Thr
                165                 170                 175

Gly Asp Asp Ser Asn Asp Asp Ala Val Ala Gly Gly Gly Ala Gly Gly
            180                 185                 190

Val Thr Ser Pro Ala Thr Arg Thr Thr Ser Pro Asn Ala Leu Leu Pro
        195                 200                 205

Glu Trp Met Asp Ala Val His Val Ala Val Gln Ala Ala Val Gln Ala
    210                 215                 220

Thr Val Gln Val Ser Gly Pro Arg Glu Asn Ala Val Ser Pro Ala Thr
225                 230                 235                 240
```

<210> 13
<211> 96
<212> PRT
<213> Human cytomegalovirus

<400> 13

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Met Ala Thr Ile Ser Thr Ser Ile Thr Pro Met Met Gly Asn Pro Thr
1               5                   10                  15

Phe Ser Gly Arg Ser Ser Met Val Thr Val Leu Cys Pro Asp Leu Arg
            20                  25                  30

Pro Ser Leu Ser Leu Leu Tyr Ser Thr Arg Ala Gly Thr Ala Pro Ser
        35                  40                  45

Thr Leu Leu Arg Ser Gly Arg Tyr Gly Val Leu Pro Arg Ala Thr Tyr
    50                  55                  60

Leu His Gly Arg Leu Asn Gly Gly Leu Asp Arg His Met His Arg Ile
65                  70                  75                  80

His Pro Phe Trp Gln Gln Cys Val Arg Arg Arg Arg Thr Ser Arg Gly
                85                  90                  95
```

<210> 14

<211> 169
<212> PRT
<213> Human cytomegalovirus

<400> 14

Met Asp Asp Leu Pro Leu Asn Val Gly Leu Pro Ile Ile Gly Val Met
1 5 10 15

Leu Val Leu Ile Val Ala Ile Leu Cys Tyr Leu Ala Tyr His Trp His
20 25 30

Asp Thr Phe Lys Leu Val Arg Met Phe Leu Ser Tyr Arg Trp Leu Ile
35 40 45

Arg Cys Cys Glu Leu Tyr Gly Glu Tyr Glu Arg Arg Phe Ala Asp Leu
50 55 60

Ser Ser Leu Gly Leu Gly Ala Val Arg Arg Glu Ser Asp Arg Arg Tyr
65 70 75 80

Arg Phe Ser Glu Arg Pro Asp Glu Ile Leu Val Arg Trp Glu Glu Val
85 90 95

Ser Ser Gln Cys Ser Tyr Ala Ser Ser Arg Ile Thr Asp Arg Arg Val
100 105 110

Gly Ser Ser Ser Ser Ser Ser Val His Val Ala Ser Gln Arg Asn Ser
115 120 125

Val Pro Pro Pro Asp Met Ala Val Thr Ala Pro Leu Thr Asp Val Asp
130 135 140

Leu Leu Lys Pro Val Thr Gly Ser Ala Thr Gln Phe Thr Thr Val Ala
145 150 155 160

Met Val His Tyr His Gln Glu Tyr Thr
165

<210> 15
<211> 135
<212> PRT
<213> Human cytomegalovirus

<400> 15

Met Leu Trp Ile Leu Val Leu Phe Ala Leu Ala Ala Ser Ala Ser Glu
1 5 10 15

Thr Thr Thr Gly Thr Ser Ser Asn Ser Ser Gln Ser Thr Ser Ala Thr
20 25 30

Ala Asn Thr Thr Val Ser Thr Cys Ile Asn Ala Ser Asn Gly Ser Ser
35 40 45

Trp Thr Val Pro Gln Leu Ala Leu Leu Ala Ala Ser Gly Trp Thr Leu
50 55 60

Ser Gly Leu Leu Leu Leu Phe Thr Cys Cys Phe Cys Cys Phe Trp Leu
65 70 75 80

Val Arg Lys Ile Cys Ser Cys Cys Gly Asn Ser Ser Glu Ser Glu Ser
85 90 95

Lys Thr Thr His Ala Tyr Thr Asn Ala Ala Phe Thr Ser Ser Asp Ala
100 105 110

Thr Leu Pro Met Gly Thr Thr Gly Ser Tyr Thr Pro Pro Gln Asp Gly
115 120 125

Ser Phe Pro Pro Pro Pro Arg
130 135

<210> 16
<211> 114
<212> PRT
<213> Human cytomegalovirus

<400> 16

Met Thr Pro Ala Gln Thr Asn Ala Thr Thr Thr Val His Pro His Asp
1 5 10 15

Ala Lys Asn Gly Ser Gly Gly Ser Ala Leu Pro Thr Leu Val Val Phe
20 25 30

Gly Phe Ile Val Thr Leu Leu Phe Phe Leu Phe Met Leu Tyr Phe Trp
35 40 45

Asn Asn Asp Val Phe Arg Lys Leu Leu Arg Ala Leu Gly Ser Ser Ala
50 55 60

Val Ala Thr Ala Ser Thr Arg Gly Lys Thr Arg Ser Ser Thr Val Val
65 70 75 80

His His Val Val Pro Arg Ala Thr Thr Arg Val Val Leu Thr Ala Cys
85 90 95

```
His Arg Thr Phe Phe Tyr His Pro Arg Pro Met Ala Val Leu Thr Thr
            100                 105                 110

Arg His
```

<210> 17
<211> 425
<212> PRT
<213> Human cytomegalovirus

<400> 17

```
Met Arg Gln Val Ala Tyr Arg Arg Arg Glu Ser Ser Cys Ala Val
1               5                   10                  15

Leu Val His His Val Gly Arg Asp Gly Asp Gly Glu Gly Glu Ala Ala
            20                  25                  30

Lys Lys Thr Cys Lys Lys Thr Gly Arg Ser Val Ala Gly Ile Pro Gly
        35                  40                  45

Glu Lys Leu Arg Arg Thr Val Val Thr Thr Thr Pro Ala Arg Arg Leu
    50                  55                  60

Ser Gly Arg His Thr Glu Gln Glu Gln Ala Gly Met Arg Leu Cys Glu
65                  70                  75                  80

Lys Gly Lys Lys Arg Ile Ile Met Cys Arg Arg Glu Ser Leu Arg Thr
                85                  90                  95

Leu Pro Trp Leu Phe Trp Val Leu Leu Ser Cys Pro Arg Leu Leu Glu
            100                 105                 110

Tyr Ser Ser Ser Ser Phe Pro Phe Ala Thr Ala Asp Ile Ala Glu Lys
        115                 120                 125

Met Trp Ala Glu Asn Tyr Glu Thr Thr Ser Pro Ala Pro Val Leu Val
    130                 135                 140

Ala Glu Gly Glu Gln Val Thr Ile Pro Cys Thr Val Met Thr His Ser
145                 150                 155                 160

Trp Pro Met Val Ser Ile Arg Ala Arg Phe Cys Arg Ser His Asp Gly
                165                 170                 175
```

```
Ser Asp Glu Leu Ile Leu Asp Ala Val Lys Gly His Arg Leu Met Asn
            180                 185                 190

Gly Leu Gln Tyr Arg Leu Pro Tyr Ala Thr Trp Asn Phe Ser Gln Leu
        195                 200                 205

His Leu Gly Gln Ile Phe Ser Leu Thr Phe Asn Val Ser Met Asp Thr
    210                 215                 220

Ala Gly Met Tyr Glu Cys Val Leu Arg Asn Tyr Ser His Gly Leu Ile
225                 230                 235                 240

Met Gln Arg Phe Val Ile Leu Thr Gln Leu Glu Thr Leu Ser Arg Pro
                245                 250                 255

Asp Glu Pro Cys Cys Thr Pro Ala Leu Gly Arg Tyr Ser Leu Gly Asp
            260                 265                 270

Gln Ile Trp Ser Pro Thr Pro Trp Arg Leu Arg Asn His Asp Cys Gly
        275                 280                 285

Thr Tyr Arg Gly Phe Gln Arg Asn Tyr Phe Tyr Ile Gly Arg Ala Asp
    290                 295                 300

Ala Glu Asp Cys Trp Lys Pro Ala Cys Pro Asp Glu Glu Pro Asp Arg
305                 310                 315                 320

Cys Trp Thr Val Ile Gln Arg Tyr Arg Leu Pro Gly Asp Cys Tyr Arg
                325                 330                 335

Ser Gln Pro His Pro Pro Lys Phe Leu Pro Val Thr Pro Ala Pro Pro
            340                 345                 350

Ala Asp Ile Asp Thr Gly Met Ser Pro Trp Ala Thr Arg Gly Ile Ala
        355                 360                 365

Ala Phe Leu Gly Phe Trp Ser Ile Phe Thr Val Cys Phe Leu Cys Tyr
    370                 375                 380

Leu Cys Tyr Leu Gln Cys Cys Gly Arg Trp Cys Pro Thr Pro Gly Arg
385                 390                 395                 400

Gly Arg Arg Gly Gly Glu Gly Tyr Arg Arg Leu Pro Thr Tyr Asp Ser
                405                 410                 415

Tyr Pro Gly Val Arg Lys Met Lys Arg
```

420 425

<210> 18
<211> 306
<212> PRT
<213> Human cytomegalovirus

<400> 18

Met Arg Ile Glu Trp Val Trp Trp Leu Phe Gly Tyr Phe Val Ser Ser
1 5 10 15

Val Gly Ser Glu Arg Ser Leu Ser Tyr Arg Tyr His Leu Glu Ser Asn
20 25 30

Ser Ser Thr Asn Val Val Cys Asn Gly Asn Ile Ser Val Phe Val Asn
35 40 45

Gly Thr Leu Gly Val Arg Tyr Asn Ile Thr Val Gly Ile Ser Ser Ser
50 55 60

Leu Leu Ile Gly His Leu Thr Ile Gln Val Leu Glu Ser Trp Phe Thr
65 70 75 80

Pro Trp Val Gln Asn Lys Ser Tyr Asn Lys Gln Pro Leu Gly Asp Thr
85 90 95

Glu Thr Leu Tyr Asn Ile Asp Ser Glu Asn Ile His Arg Val Ser Gln
100 105 110

Tyr Phe His Thr Arg Trp Ile Lys Ser Leu Gln Glu Asn His Thr Cys
115 120 125

Asp Leu Thr Asn Ser Thr Pro Thr Tyr Thr Tyr Gln Val Asn Val Asn
130 135 140

Asn Thr Asn Tyr Leu Thr Leu Thr Ser Ser Gly Trp Gln Asp Arg Leu
145 150 155 160

Asn Tyr Thr Val Ile Asn Ser Thr His Phe Asn Leu Thr Glu Ser Asn
165 170 175

Ile Thr Ser Ile Gln Lys Tyr Leu Asn Thr Thr Cys Ile Glu Arg Leu
180 185 190

Arg Asn Tyr Thr Leu Glu Ser Val Tyr Thr Thr Thr Val Pro Gln Asn
195 200 205

```
Ile Thr Thr Ser Gln His Ala Thr Thr Thr Met His Thr Ile Pro Pro
    210                 215                 220

Asn Thr Ile Thr Ile Gln Asn Thr Thr Gln Ser His Thr Val Gln Thr
225                 230                 235                 240

Pro Ser Phe Asn Asp Thr His Asn Val Thr Lys His Thr Leu Asn Ile
                245                 250                 255

Ser Tyr Val Leu Ser Gln Lys Thr Asn Asn Thr Thr Ser Pro Trp Ile
            260                 265                 270

Tyr Ala Ile Pro Met Gly Ala Thr Ala Thr Ile Gly Ala Gly Leu Tyr
        275                 280                 285

Ile Gly Lys His Phe Thr Pro Val Lys Phe Val Tyr Glu Val Trp Arg
    290                 295                 300

Gly Gln
305
```

<210> 19
<211> 92
<212> PRT
<213> Human cytomegalovirus

<400> 19

```
Met Ala Arg Ser Val Lys Thr Ile Arg Ile Gln His Ile Tyr Ser Pro
1               5                   10                  15

Arg Ser Ser Asn Thr Leu Gln His Met Ser Lys Lys Gln Glu Ser Ile
            20                  25                  30

Ala Thr Ile Thr Phe Gly Arg Ile Thr Cys Cys His Pro Leu Ala Ser
        35                  40                  45

Ile Asn Leu Met Phe Asn Gly Ser Cys Thr Val Thr Val Lys Ile Ser
    50                  55                  60

Met Gly Ile Asn Gly Ser Thr Asn Val His Gln Leu Val Ile Val Leu
65                  70                  75                  80

His Leu Gly Asn Arg Cys Gln Pro Trp Arg Gln Val
                85                  90
```

<210> 20

<211> 176
<212> PRT
<213> Human cytomegalovirus

<400> 20

Met Lys Pro Leu Ile Met Leu Ile Cys Phe Ala Val Ile Leu Leu Gln
1 5 10 15

Leu Gly Val Thr Lys Val Cys Gln His Asn Glu Val Gln Leu Gly Asn
20 25 30

Glu Cys Cys Pro Pro Cys Gly Ser Gly Gln Arg Val Thr Lys Val Cys
35 40 45

Thr Asp Tyr Thr Ser Val Thr Cys Thr Pro Cys Pro Asn Gly Thr Tyr
50 55 60

Val Ser Gly Leu Tyr Asn Cys Thr Asp Cys Thr Gln Cys Asn Val Thr
65 70 75 80

Gln Val Met Ile Arg Asn Cys Thr Ser Thr Asn Asn Thr Val Cys Ala
85 90 95

Pro Lys Asn His Thr Tyr Phe Ser Thr Pro Gly Val Gln His His Lys
100 105 110

Gln Arg Gln Gln Asn His Thr Ala His Ile Thr Val Lys Gln Gly Lys
115 120 125

Ser Gly Arg His Thr Leu Ala Trp Leu Ser Leu Phe Ile Phe Leu Val
130 135 140

Gly Ile Ile Leu Leu Ile Leu Tyr Leu Ile Ala Ala Tyr Arg Ser Glu
145 150 155 160

Arg Cys Gln Gln Cys Cys Ser Ile Gly Lys Ile Phe Tyr Arg Thr Leu
165 170 175

<210> 21
<211> 100
<212> PRT
<213> Human cytomegalovirus

<400> 21

Met Cys Thr Asp Pro Arg Arg Thr Ala Gly Trp Glu Arg Leu Thr His
1 5 10 15

```
His Ala Ser Tyr His Ala Asn Tyr Gly Ala Tyr Ala Val Leu Met Ala
            20                  25                  30

Thr Ser Gln Arg Lys Ser Leu Val Leu His Arg Tyr Ser Ala Val Thr
        35                  40                  45

Ala Val Ala Leu Gln Leu Met Pro Val Glu Ile Val Arg Lys Leu Asp
    50                  55                  60

Gln Ser Asp Trp Val Arg Gly Ala Trp Ile Val Ser Glu Thr Phe Pro
65                  70                  75                  80

Thr Ser Asp Pro Lys Gly Val Trp Ser Asp Asp Asp Ser Ser Met Gly
                85                  90                  95

Gly Ser Asp Asp
            100
```

<210> 22
<211> 117
<212> PRT
<213> Human cytomegalovirus

<400> 22

```
Met Arg Leu Ile Phe Gly Ala Leu Ile Ile Phe Leu Ala Tyr Val Tyr
1               5                   10                  15

His Tyr Glu Val Asn Gly Thr Glu Leu Arg Cys Arg Cys Leu His Arg
            20                  25                  30

Lys Trp Pro Pro Asn Lys Ile Ile Leu Gly Asn Tyr Trp Leu His Arg
        35                  40                  45

Asp Pro Arg Gly Pro Gly Cys Asp Lys Asn Glu His Leu Leu Tyr Pro
    50                  55                  60

Asp Gly Arg Lys Pro Pro Gly Pro Gly Val Cys Leu Ser Pro Asp His
65                  70                  75                  80

Leu Phe Ser Lys Trp Leu Asp Lys His Asn Asp Asn Arg Trp Tyr Asn
                85                  90                  95

Val Asn Ile Thr Lys Ser Pro Gly Pro Arg Arg Ile Asn Ile Thr Leu
            100                 105                 110

Ile Gly Val Arg Gly
        115
```

<210> 23
<211> 159
<212> PRT
<213> Human cytomegalovirus

<400> 23

Met Val Leu Thr Trp Leu His His Pro Val Ser Asn Ser His Ile Asn
1 5 10 15

Leu Leu Ser Val Arg His Leu Ser Leu Ile Ala Tyr Met Leu Leu Thr
20 25 30

Ile Cys Pro Leu Ala Val His Val Leu Glu Leu Glu Asp Tyr Asp Arg
35 40 45

Arg Cys Arg Cys Asn Asn Gln Ile Leu Leu Asn Thr Leu Pro Val Gly
50 55 60

Thr Glu Leu Leu Lys Pro Ile Ala Ala Ser Glu Ser Cys Asn Arg Gln
65 70 75 80

Glu Val Leu Ala Ile Leu Lys Asp Lys Gly Thr Lys Cys Leu Asn Pro
85 90 95

Asn Ala Gln Ala Val Arg Arg His Ile Asn Arg Leu Phe Phe Arg Leu
100 105 110

Ile Leu Asp Glu Glu Gln Arg Ile Tyr Asp Val Val Ser Thr Asn Ile
115 120 125

Glu Phe Gly Ala Trp Pro Val Pro Thr Ala Tyr Lys Ala Phe Leu Trp
130 135 140

Lys Tyr Ala Lys Arg Leu Asn Tyr His His Phe Arg Leu Arg Trp
145 150 155

<210> 24
<211> 316
<212> PRT
<213> Human cytomegalovirus

<400> 24

Met Leu Arg Leu Leu Phe Thr Leu Val Leu Leu Ala Leu His Gly Gln
1 5 10 15

Ser Val Gly Ala Ser Arg Asp Tyr Val His Val Arg Leu Leu Ser Tyr

```
            20                  25                  30

Arg Gly Asp Pro Leu Val Phe Lys His Thr Phe Ser Gly Val Arg Arg
        35                  40                  45

Pro Phe Thr Glu Leu Gly Trp Ala Ala Cys Arg Asp Trp Asp Ser Met
    50                  55                  60

His Cys Thr Pro Phe Trp Ser Thr Asp Leu Glu Gln Met Thr Asp Ser
65                  70                  75                  80

Val Arg Arg Tyr Ser Thr Val Ser Pro Gly Lys Glu Val Thr Leu Gln
                85                  90                  95

Leu His Gly Asn Gln Thr Val Gln Pro Ser Phe Leu Ser Phe Thr Cys
            100                 105                 110

Arg Leu Gln Leu Glu Pro Val Val Glu Asn Val Gly Leu Tyr Val Ala
        115                 120                 125

Tyr Val Val Asn Asp Gly Glu Arg Pro Gln Gln Phe Phe Thr Pro Gln
    130                 135                 140

Val Asp Val Val Arg Phe Ala Leu Tyr Leu Glu Thr Leu Ser Arg Ile
145                 150                 155                 160

Val Glu Pro Leu Glu Ser Gly Arg Leu Ala Val Glu Phe Asp Thr Pro
                165                 170                 175

Asp Leu Ala Leu Ala Pro Asp Leu Val Ser Ser Leu Phe Val Ala Gly
            180                 185                 190

His Gly Glu Thr Asp Phe Tyr Met Asn Trp Thr Leu Arg Arg Ser Gln
        195                 200                 205

Thr His Tyr Leu Glu Glu Met Ala Leu Gln Val Glu Ile Leu Lys Pro
    210                 215                 220

Arg Gly Val Arg His Arg Ala Ile Ile His His Pro Lys Leu Gln Pro
225                 230                 235                 240

Gly Val Gly Leu Trp Ile Asp Phe Cys Val Tyr Arg Tyr Asn Ala Arg
                245                 250                 255

Leu Thr Arg Gly Tyr Val Arg Tyr Thr Leu Ser Pro Lys Ala Arg Leu
            260                 265                 270
```

```
Pro Ala Lys Ala Glu Gly Trp Leu Val Ser Leu Asp Arg Phe Ile Val
        275                 280                 285

Gln Tyr Leu Asn Thr Leu Leu Ile Thr Met Met Ala Ala Ile Trp Ala
    290                 295                 300

Arg Val Leu Ile Thr Tyr Leu Val Ser Arg Arg Arg
305                 310                 315
```

<210> 25
<211> 122
<212> PRT
<213> Human cytomegalovirus

<400> 25

```
Met Val Asp Gln Cys Cys Tyr Arg His Leu His Arg Ser Leu Ser Gly
1               5                   10                  15

Gly Pro Asp Val Leu Tyr Ala Ala Ala Gly Thr Gln Arg Glu Gln Gln
            20                  25                  30

Arg Leu Asp Lys Ser Leu Ala Ala Thr Ala Pro Ser Ala Val Ala Gly
        35                  40                  45

Pro Pro Ala Asp Arg Asp Val Val Asp His Arg Thr Glu Thr His Ala
    50                  55                  60

Tyr Glu Thr Pro Arg Tyr Ala Thr Arg Cys Leu Thr Arg Tyr Thr Thr
65                  70                  75                  80

Pro Val Arg Ser Ala Val Arg Arg Thr Thr Cys Gly Lys Arg Val Ala
                85                  90                  95

Ser Gln Ser Pro Pro Arg Ser Cys Leu Val Ala Pro Gln Ser Ser Pro
            100                 105                 110

Ala His Pro Pro Arg His Pro Glu Gly Gly
        115                 120
```

<210> 26
<211> 642
<212> PRT
<213> Human cytomegalovirus

<400> 26

```
Met Gln Leu Cys Ser His Ser Ile Ser Ser Gln Arg His Val Ala Ser
```

```
1               5                   10                  15

Ser Met His Cys Arg Ser Arg His Gln Arg Thr Pro Pro Ser Ala Thr
            20                  25                  30

Thr His Gly Pro Cys Ala Pro Thr Ser Arg Ile Leu Arg Arg Leu Leu
        35                  40                  45

Thr Thr Arg Arg Phe Leu Pro Arg Thr Pro Ser Pro Ser Asn Thr Val
    50                  55                  60

Cys Cys Ile Arg Arg Arg Leu His Glu Arg Thr Ile Arg His Ser Met
65                  70                  75                  80

Arg Cys Arg Arg Arg Asp Met Ala Ser Ser Ala Ser Thr Pro Val Ser
                85                  90                  95

His Thr Gln Pro Leu Ala Ala Asn His Arg Arg Ser Arg Ile Thr Tyr
            100                 105                 110

Ala Thr Thr Asp Pro Thr Asn Ser Pro Thr Ala Ser Pro Ala Lys Ser
        115                 120                 125

Asp Lys Leu Glu Ala Asp Ala Asp Pro Ala Leu His Arg Arg Pro Ala
    130                 135                 140

Ser Leu Leu Arg His Leu Phe Gln Pro Cys His Ala Gln Arg Gly Thr
145                 150                 155                 160

Ser Asn Arg Ala Thr Ser Gln Arg Ala Ser Leu Asn Ala Val His His
                165                 170                 175

Lys Leu Cys Gly Ala Met Ile Ser Ser Ser Cys Ser Thr Thr Cys Thr
            180                 185                 190

Pro Leu Ile Met Asp Leu Pro Ser Leu Ser Val Glu Leu Ser Ala Gly
        195                 200                 205

His Lys Lys Lys Glu Thr Pro Thr Glu Gly Gly Trp Gly Gly Glu Glu
    210                 215                 220

Gly Glu Asp Asp Val Leu Ala Thr Ile Arg Asn Thr Leu Ser Ala Pro
225                 230                 235                 240

Thr Ser Pro Ala Ala Ala Thr Thr His Arg Leu Ser Phe Pro Gly Glu
                245                 250                 255
```

```
Ser Thr Phe Cys Leu Thr Ala Val Ser Glu Cys Ser Gln Arg Arg Thr
            260                 265                 270

Ser Thr Ala Ala Leu Thr Pro Pro Pro Ala Val Ala Ala Ala Phe
        275                 280                 285

Ser Phe Ser Ser Thr Val Ser Glu Thr Gly Thr Phe Pro Gln Ser Thr
    290                 295                 300

Thr Gly Arg Thr Arg Val Asp Asp Thr Ala Val Val Thr Ala Gly Asp
305                 310                 315                 320

Pro Arg Ser Pro Val Thr His Val Thr Leu Leu Gln Ile Phe Arg Leu
                325                 330                 335

Arg Ser Ser Leu Leu Thr Ser Arg Ser Gly Gly Ala Leu Arg Gly Gly
            340                 345                 350

Glu His Glu Ala Ile Pro Lys Val Ala Ser Leu Phe Trp Thr Leu Leu
        355                 360                 365

Lys Ala Thr Gln Ile Val Glu Met Thr His Lys Thr Pro Ser Ala Asp
    370                 375                 380

Ser His Arg Asn Pro Gln Lys Tyr Thr Asp Arg Pro Gln Arg Leu Leu
385                 390                 395                 400

Leu Thr Ala Leu Ala Ile Trp Gln Arg Thr Tyr Asn Asp Thr Arg Ala
                405                 410                 415

Ala His Ala Pro Gln Val Arg Leu Leu Gly Asp Ile Leu Thr Tyr Arg
            420                 425                 430

Arg Pro Gln Thr Ala Thr Ala Ser Thr Lys Ala His Thr Gln Gln Gln
        435                 440                 445

Pro Glu Glu Pro Lys Gly Gln Gln Ile Trp Thr Gln Thr Ala Gly Gln
    450                 455                 460

Ala Ala Pro His Gly Asp Glu Pro His Ser Asp Gly Glu Leu Arg Arg
465                 470                 475                 480

Glu Ser His Ser Ala Pro Pro Thr Ser Arg Thr Leu Pro Asp Thr Ile
                485                 490                 495
```

```
Leu Ala Val Lys Arg Arg Ser Val Ala Gln Arg Ser His Val Arg Leu
            500                 505                 510

Asp Ala Lys Pro Gly Leu Asn Glu Arg Asp Gly Phe Arg Gln Arg Leu
        515                 520                 525

Leu Leu Pro Leu Ser Gly Tyr Phe Arg Ala Asn Glu Leu Arg Asn Gln
    530                 535                 540

Gln Phe Met Gly Tyr Gly Thr Lys Asn Gly Leu Lys Asn Thr Trp Leu
545                 550                 555                 560

Thr Arg Pro Leu Gly Val Ala Gly Gly Val Arg Glu Thr Ile Gly Glu
                565                 570                 575

Arg Gln Asp Arg Asn Val Ala Asp Ser Ala Thr Gln Arg Val Phe His
            580                 585                 590

Thr Leu Tyr Ala Ala Leu Gln Thr Val Arg Val Trp Tyr Thr Ala Leu
        595                 600                 605

Gly Thr Ala Trp Arg Thr Ser Gly Ser Arg Thr Arg Glu Ser Leu Phe
    610                 615                 620

Asp Gly Pro Arg Arg Arg Asp Arg Gln Ala Ala Arg Leu Arg Arg Leu
625                 630                 635                 640

Glu Leu
```

<210> 27
<211> 336
<212> PRT
<213> Human cytomegalovirus

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<221> MISC_FEATURE
<222> (47)..(47)
<223> X is unknown (one of the naturally occurring amino acids)

<220>
<221> MISC_FEATURE
<222> (49)..(49)
<223> X is unknown (one of the naturally occurring amino acids)

<220>
<221> MISC_FEATURE
<222> (115)..(115)
<223> X is unknown (one of the naturally occurring amino acids)

<400> 27

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Met Val Phe Val Ser Gly Thr Ala Leu Gly Thr Gly Phe His Arg Ala
1               5                  10                  15

Glu Gly Ser Phe Cys Gly Cys Glu Gly Arg Ser Phe Phe Arg Thr Leu
            20                  25                  30

Gly Thr Gly Leu Gly Asp Gly Gly Cys Ala Gly Arg Arg Trp Xaa Arg
        35                  40                  45

Xaa Val Ala Gly Thr Gly Ile Thr Leu Gly Thr Gly Thr Arg Gly Pro
    50                  55                  60

Gly Leu Arg Asp Gly Gly Asp Gly Gly Val Cys Gly Glu Asp Gly Gly
65                  70                  75                  80

Leu Leu Arg Arg Gly Arg Gly Leu Ala Gly Pro Ala Val Ala Gly Val
                85                  90                  95

Cys Gly Asp Gly Gly Leu Leu Gln Arg Arg Gly Leu Arg Gly Gln Glu
            100                 105                 110

Cys Ala Xaa Pro Gly Gly Phe Ala Gly Gly His Gly Thr Gly Gly Gly
        115                 120                 125

Gly Asp Ser Thr Asn His Thr His Thr Gln Leu Thr Ser Ala Val Ala
    130                 135                 140

Leu Ser Glu Pro Pro Leu Phe Phe Ile Asn Val Leu Ile Pro Pro Ala
145                 150                 155                 160

Tyr Thr Arg Asn Ala Ala Cys Ser Tyr Ala His Thr Leu Ser Leu His
                165                 170                 175

Ser Asp Met Leu Leu Arg Leu Cys Thr Ala Ala Ala Asp Thr Ser Gly
            180                 185                 190

His Arg His Leu Pro Pro His Met Ala His Val Leu Arg Arg Pro Ala
        195                 200                 205

Ser Tyr Val Val Cys Ser Gln His Gly Ala Phe Phe Pro Ala Arg His
    210                 215                 220

Leu His Arg Thr Pro Ser Ala Ala Phe Ala Val Ala Ser Thr Arg Glu
225                 230                 235                 240
```

```
Gln Tyr Ala Thr Ala Cys Ala Val Ala Ala Ala Thr Trp Pro Pro Arg
                245                 250                 255

Leu Pro His Leu Phe Arg Thr Pro Asn Leu Trp Leu Pro Thr Thr Asp
            260                 265                 270

Val Gln Gly Ser Arg Thr Arg Arg Pro Ile Pro Pro Ile Leu Gln Arg
        275                 280                 285

Pro Arg Pro Pro Ser Gln Thr Ser Trp Lys Pro Thr Gln Thr Gln His
    290                 295                 300

Ser Ile Asp Ala Arg Pro Arg Cys Cys Ala Thr Ser Ser Ser Pro Ala
305                 310                 315                 320

Thr Pro Asn Ala Ala Leu Pro Thr Glu Pro His Pro Arg Gly Leu Pro
                325                 330                 335
```

<210> 28
<211> 11950
<212> DNA
<213> Human herpesvirus 5 (AD169)

<400> 28

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tgaccttgtt tttgttctgt tttctcttgt tgggaatcgt cgactttgaa ttcttcgagt    180

tatcggaaag ctgaggtacc caaatgtctg tagctttttt ctttttaccc tcttgtttat    240

catctgcgat tcgtggtagg taggagaggg aaatgataat ccgagattaa ggaaaggaga    300

agataaaaaa taaaaaaaaa taataaaaca gaagccgacc ggccgccgac ccgttcccca    360

ggaccagcct acgaggaacg gataacgcgg tggcgacggc agcggtggtg gcgctggggg    420

tggcggcagt ggtactgctg atggtagtcg ggacggagga gaggcgatgc atacatacac    480

gcgtgcatgc tgcatgggtg gatggtacgg ccgggagacg cggaagagaa actcacataa    540

aaaggtgaca aaaagagcgg ttgaaaaaag aaaacaagat tcgaccagac agaagagaag    600

gaccggggct tggcgaccct tccacgactg ctgttgtcat ctcggctcct ccgtcttctc    660

ccggccacgg gcggctaagt caccgccgtt ctccccatcc gtccgagcgc cgaccgacca    720

gccggccgat tcgcccgccg gggcttctgg agaacgccgg ggcagcagcg atctggggaa    780

gctgctaaac ccctgcgttt ttatatggta gctctgccga gcgcgggctg acgcgttggg    840
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taagcggaaa gacgtgtgtg acgaaaaggg gtcccatggt atttcacgtg acgatgagga 900

gatacggttt ggagcacata cggtttagaa aaagggagtt gtcgtgacaa gggctgaggg 960

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tttcctaacg gcgtaactta aagtgattaa cgtatgatat ttgttcccca gagttatact 1140

atagtcatca tcctaaaatt cagatataaa tgaacacatg tcgtatggga ttattaagaa 1200

accgaaactc tccacagttc accatcttct tcgtcattca accgatgacc cactccgtac 1260

aacgaatcag tctgctgcgt catattgcaa agcacaagcg acgtatgcga acaacttgaa 1320

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gtccagcccc tgcgtatgta ccagtccaag cacgtccggt cattgttcta cacaggaaat 1680

ctaactaggt caacgcaatt ttattccacc gttacgcaga atactaacaa aaaaacacac 1740

aaatttaacg aattacacgt agtttattac atgaaaactg taagaacacc aattcactaa 1800

gcgatacaac atttagctga cttccaagtg ccacacatca ccactgtatt catccatgtt 1860

ttcaccgaac caacgagaca gatcgaagaa gccagaatct cccgacttta aattacataa 1920

atccaacgta ttatgaccac agctcgacac acaaatagtt gcgttactat tcacagtagc 1980

attacctata cccgtaacgt tgcacaacca ctgatcacca ttgttaccaa aaacggtttt 2040

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ttttagctca ttacgagtat tatccgcatc cacatatatc aacgtcatag ctaggcacgc 2160

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aaccagctta tgtaccagcc acaatcacat ccggttattg tttccacagg aaatcctacc 2340

aggcaaagcc ccgcttgttt tgttcctatc ttgtttagca attcgtaaac tgtcagccta 2400

gcgacgtccg tttagatcaa aagtcacgta tatagcgacg ctgtttccat ccgtttcccc 2460

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ctcgcgtccg gttgggtatc acccacagga agatgagtca caacttccaa accatcttga 3660

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gctgtttctg ttgtggctct ctccagtttc ctcatcaccg tcccggtctc cgtcgtcatc 3780

ggaagaatac cacccgctct catgcggcag tcgatcggcc tcgacgaacg agacgcggcg 3840

acgcctctcc acggccgact ggttgtggtg gtgaaagaag agcaccagca atcccaggag 3900

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